filter **42**, and a positive displacement main fuel pump **44**, finally entering the fuel controller **40**. It should be noted that the main fuel pump **44** is driven by the engine **10** and thus has a pump speed proportional to the engine speed.

As discussed in the preceding section, the main fuel pump **44** develops a volumetric flow rate dependent upon the pump shaft speed and is therefore sized to provide a fuel flow at the pump outlet **46** in excess of the metered fuel flow rate. The fuel controller **40** accepts the fuel from the pump outlet **46** and divides the flow stream between a supply line **48** which is routed to the combustion section **50** of the gas turbine engine **10**, and a bypass line **52**. The fuel flow rate in the supply line **48** is the metered fuel flow rate as determined by the fuel controller **40** while the fuel flow in the bypass line **52** is equal to the excess main pump fuel delivery.

In this first embodiment of the present invention, the bypass line **52** includes two branches, a first branch **54** and a second branch **56** together providing a means for returning and distributing the bypass flow between two return locations **58**, **60**, respectively. The first and second return locations **58**, **60** are disposed respectively upstream of the first fuel-oil heat exchanger **20**, and intermediate the first and second fuel-oil heat exchangers **20**, **28**. The flow of bypass fuel is allocated between the locations **58**, **60** by a diverter valve **62** operable between a first position wherein the entire flow of bypass fuel in the bypass line **52** is directed to the first return location **58**, and a second position (not shown) wherein the entire bypass fuel flow is directed to the second location **60**. It should be noted at this time that although the diverter valve **62** is disclosed as operating in an either/or fashion for diverting the entire bypass fuel stream, it may be useful under some circumstances to employ a partial diverter valve operable for dividing the bypass fuel between the first and second branches **54**, **56** in a proportional manner.

It is preferable to operate the diverter valve **62** responsive to an engine operating parameter related to the rate of heat rejection to the oil loops **14**, **16**. One such parameter is the fuel pressure rise across the engine driven boost pump **36** which is related to engine speed.

In operation, fuel and oil flow in the above-described systems with heat exchange therebetween accomplished in the fuel-oil heat exchangers **20**, **28**. Under conditions of low engine power, such as idling either on the ground or in flight, the metered fuel flow rate is relatively low, matching the fuel demand of the engine **10**. As the engine shaft speed at idle is also relatively low as compared to cruise or full power levels, the output of the positive displacement main fuel pump **44**, although much greater than the metered fuel flow rate, is also reduced. The diverter valve **62** is positioned during these periods to direct the entire bypass fuel flow to the first return location **58** through the first return branch **54**. In this configuration, the entire bypass fuel flow and metered fuel flow pass sequentially through the first and second fuel-oil heat exchangers **20**, **28**.

During extended periods of idling resulting in excessive heat buildup in the recirculating fuel, the first fuel-oil heat exchanger **20** acts to remove heat from the fuel by transferring heat in the reverse direction into the first oil loop **14**. This heat is removed from the loop **14** by opening the valve **24** to admit a flow of cooling air **22** through the first air-oil cooler **18**. Similarly, during periods of inflight engine shutdown, heat removed from the windmilling engine, accessory drive, and recirculating fuel is rejected from the system through the air-oil coolers **18**, **26**.

During periods of full power or cruise engine operation, the diverter valve **62** is moved to the second position wherein the entire flow of bypass fuel is returned to the second return location **60** through the branch **56**. In this configuration, the fresh supply of fuel from the fuel tank **34** forms the entire fuel flow through the first fuel-oil heat exchanger **20** wherein the fuel absorbs heat from the circulating oil in the first loop **14**. The second fuel-oil heat exchanger **28** receives both the bypass fuel returned by the controller **40** as well as the fuel flowing from the first fuel-oil heat exchanger **20**. This combined fuel flow passes through the second fuel-oil heat exchanger **28**, cooling the oil circulating in the second oil loop **16**, and passing subsequently through the filter **42** and main fuel pump **44**.

It will be appreciated that during operation at these higher power levels, both the metered fuel flow rate and the main fuel pump delivery rate are considerably higher than those under idle conditions. The high metered fuel flow rate provides adequate total heat capacity in the supplied fuel stream for absorbing all the heat energy generated by the accessory drive **12** and the engine **10** thus allowing closure of the first and second airflow regulating valves **24**, **32** improving overall engine efficiency.

Additionally, by redirecting the bypass fuel return flow from the first location **58** to the second location **60** downstream of the first fuel-oil heat exchanger **20** increases the temperature effectiveness of the first fuel-oil heat exchanger **20** which receives only fresh fuel from the fuel tank **34**, unmixed with the warmer bypass fuel stream. This flow configuration insures that the maximum cooling capacity of the fresh fuel stream is available to the accessory drive unit **12** through the first oil cooling loop **14** when the engine operates at full or cruising power

One final feature of the embodiment of FIG. **1** are oil bypass lines **64**, **65** disposed in the oil loops **14**, **16** for directing oil around the respective fuel-oil heat exchangers **20**, **28**. The bypass flows are regulated by control valves **66**, **67** which are opened responsive to fuel and oil temperature during periods, such as at idle, wherein the fuel is too hot to absorb additional heat energy, thereby allowing the system to more flexibly accommodate the needs of the various systems.

By placing the fuel-oil heat exchangers **20**, **28** upstream of the main fuel pump **44** and the fuel filter **42**, the heat management system according to the present invention also reduces or eliminates the need for auxiliary fuel heating to avoid icing up of the fuel filter **42** under extremely cold operating conditions.

FIG. **2** shows a schematic representation of a second embodiment of the heat management system according to the present invention wherein like reference numerals are used to denote elements in common with the embodiment shown in FIG. **1**. The second embodiment according to the present invention distributes the bypass fuel flowing in bypass line **52** between two return locations on the low pressure side of the main fuel pump **44**, a first location **58** via a first branch **54**, and a third location **68**, via a third branch **70**. It will be appreciated that the return location and branch denoted by reference numerals **68** and **70**, while forming the only other location and branch in the disclosed second embodiment according to the present invention, are termed the third location and third branch to distinguish from the